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Sustainable development and energy education in Nigeria

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ABSTRACT

Increasing demands for energy, growing environmental concerns and the constraints of conventional energy sources have generated the need for public education on renewable energy, and the need for government policy to embrace renewable energy technologies. This paper is based on a previous study that explored the beliefs, perceptions and attitudes of the Nigerian public to renewable energy technologies so as to derive implications for science and technology policy and education in the country. A sequential mixed-method approach was employed in the study. First, a survey with close-ended questions was administered to 600 randomly selected participants from Ibadan, Akobo and Asi. This was followed by four focus group interviews held with 23 purposefully selected participants from the study. Statistical and thematic analyses were conducted. The results show that the participants have a low-level knowledge of renewable energy technologies. There is also no relationship between the educational level of the participants and their knowledge of renewable energy technologies. The majority of the participants were not aware of sustainable development. The outcome of this study underscores the need to widen the nation's science and technology policies as well as its educational curriculum to incorporate themes addressing renewable energy and sustainable livelihood.

1. Rationale for the study

Sustainable development has been defined as "meeting the needs of the present without compromising the ability of future generations to meet their needs" [1]. Increasing demands for energy, growing environmental concerns and the constraints of conventional energy sources have generated the need for public education on renewable energy, and the need for government policy to embrace renewable energy technologies [2]. However, the implementation of RETs has been hindered primarily by lack of public acceptance [3–5].

According to DeWaters and Powers [6], energy literacy, a term that integrates wide knowledge content, attitude formation and behavioural characteristics, will not only enable citizens to conserve energy, it will also help them to make appropriate energy–related decisions. UNECE [7] also states that "education, in addition to being a human right, is a prerequisite for achieving sustainable development and an essential tool for good governance, informed decision-making and the promotion of democracy. Education for sustainable development develops and strengthens the capacity of individuals, groups, communities, organizations and countries to make judgements and choices in favour of sustainable development".

There is a dearth of qualitative studies that could provide a detailed picture of the public understanding of renewable energy technology in Nigeria. This study used a sequential mixed method approach to gain an in-depth understanding of the public about RETs. While the qualitative part allowed for an in-depth analysis of the participants' experiences, the quantitative study allowed for the testing of variables to determine the relationship between them. Moreover, a quantitative study can also be used for large populations and the results can be generalized. The paper concludes by highlighting the roles of effective renewable energy education in inculcating the concept of sustainability in Nigerian citizens.

2. Background

The close relationship between renewable energy and sustainable development is prompting countries of the world to adopt renewable energy technologies in order to ensure sustainable development. Renewable energy education is essential for successful implementation of renewable energy technologies and for public support. Chapter 36 of Agenda 21 of the United Nations

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Commission on Environment Development specified the importance of education in achieving sustainable development,

> "Both formal and non-formal education is indispensable to changing people's attitudes so that they have the capacity to assess and address their sustainable development concerns. It is also critical for achieving environmental and ethical awareness, values and attitudes, skills and behaviour consistent with sustainable development and for effective public participation in decision-making" [8,9].

Before there can be the achievement of a sustainable energy programme, all stakeholders must be well educated.

Lack of public acceptance is a major setback to the development of renewable energy resources and their penetration into electricity production in Nigeria's energy supply system [2]. In line with the national policy on renewable energy, some pilot projects have been carried out. Examples of such pilot projects include Dome Type Biogas Pilot Plant at Danjawa Village, Wamakko LG, Sokoto State, 2-tonne Solar Rice Dryer at Adarice Company Enugu, Solar PV for Telecommunication 20-km Kaduna-Abuja Road [10], Cows-to-Kilowatts Nigeria in Ibadan [11], and the Niger Delta Wetland Centre [12] to mention but a few. Despite all these projects, widespread acceptance of the renewable energy technologies is yet to be achieved in Nigeria [13].

According to DeWaters and Powers [6], energy literacy that integrates wide knowledge content, attitude formation and behavioural characteristics will not only enable citizens to conserve energy, it will also help them to make appropriate energy−related decisions. Scientific knowledge makes it easier for people to compare the risks and benefits of each type of application, thus enabling them to make more specific value judgements [14].

> "Creating a more sustainable future will not occur simply by increasing the amount of education; instead, it is an issue of content and relevance. Questioning, rethinking, and revising education from pre-school through university to include more principles, knowledge, skills, perspectives and values related to sustainability in each of the three realms − environment, society, and economy − is important to our current and future societies" [15].

It is for the above reasons that renewable energy education is regarded as essential for the successful implementation of renewable energy technologies and for public support.

3. Theoretical framework

This study is informed by the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM). TRA posits that beliefs about an object influence a person's attitude towards that object. Beliefs are that which an individual perceives to be true. They are also defined as an individual's subjective knowledge and emotions concerning objects and their relationship, and are usually based on personal experience [16]. This study asserts that knowledge is an integral part of beliefs. Knowledge has been defined as the comprehension or awareness of an idea or proposition [17]. The Oxford Dictionary also defines knowledge as 'facts, information, and skills acquired through experience or education' [18]. It can be argued that beliefs are based on knowledge. According to Griffin and Ohlsson [17], knowledge refers to the representation of a proposition, and beliefs refer to the representation of a truth-value associated with a proposition. The more an individual's beliefs are based on relevant knowledge, the more willing they are to change the beliefs in the face of conflicting evidence. We can then say that knowledge and beliefs are interconnected; although the two constructs are distinct, they are embedded in each other.

According to Fishbein and Ajzen [19], an individual's attitude is his/her tendency to respond either positively or negatively towards an object. The decision to behave in a particular way is a result of deliberate consideration of available information and the consequence of the behaviour [20]. Attitudes towards an object can be divided into three components: the cognitive, the affective and the behavioural components [21,22]. The cognitive component consists of the knowledge and beliefs that a person holds about the object; the affective component comprises the emotions or feelings about the object; and the behavioural component involves the Behavioural Intention or response of the individual.

The Technology Acceptance Model (TAM) is considered an extension of TRA. In it, the evaluation of the belief's consequences in TRA was replaced with Perceived Usefulness (PU) and Perceived Ease of Use (E). It has been argued that knowledge about how RETs work, and their effects, influence consumers' perceptions and acceptance of such technologies [23]. Therefore, in this study, knowledge of RETs is linked to beliefs about RETs and the evaluation of beliefs consequences as factors that determine attitude to RETs.

4. Research methodology

As pointed out earlier, a sequential mixed method approach was used to explore Nigeria's public understanding of RETs in relation to sustainable living. While the qualitative part allowed for an in-depth analysis of the participants' experiences, the quantitative study allowed for the testing of variables to determine the relationships between them. It is also useful for large populations and the results can be generalized. The study was conducted in the Oyo state of Nigeria. Ibadan, the capital city of the Oyo state, is a mega city; it has the largest metropolitan geographical area in the country, and boasts different categories of Nigerian people. Available data on the population of the Oyo State in Nigeria, based on the 2006 census, shows that the population of the Oyo State was 5,580,894 [24]. 50% of the total population was male, while 49.7% was female. There is thus a gender balance that is uniformly distributed over the state [25].

The sampling technique employed in this study consisted of stratified quota sampling. Based on the population data available, the participants were stratified into two groups of male and female. The total population of the locations covered by the study (Ibadan North, Ibadan North East, Ibadan North West, Ibadan South West and Ibadan South East) was 1,497,526 [24]. For the survey, 600 participants were sampled. Also, sampling was done such that 400 participants were sampled within the urban areas of Ibadan metropolis while the remaining 200 participants were sampled from the sub-urban areas.

The survey instrument used in the research contained 14 closed-ended questions. The design of the instrument was guided by the theoretical background of the study. Five questions were asked in relation to knowledge and beliefs. These questions covered the knowledge of terms related to renewable energy that the participants were aware of; how knowledgeable the participants were about RETs; the types of technology they were familiar with; sources of information about RET; and the reasons why they thought that renewable energy should replace fossil fuels. The rest of the questions were based on respondents' perception and attitude to renewable energy technologies, as well as their intention for sustainable energy usage.

A pilot study was conducted to test the research instruments. The research questionnaire was administered to 30 selected

participants in the Ibadan Oyo State; they did not form part of the study. This served the purpose of making sure that the piloting was done exactly as the main study would be done [26]. An analysis of the pilot responses did not indicate the need for any changes to the instrument. The survey instrument was also tested for internal consistency using Cronbach's alpha reliability test. Cronbach's alpha is a measure used to assess the reliability, or internal consistency, of a set of scale or test items. It is most commonly used for multiple Likert scale statements to test if the scale is a consistent measure of a concept [27]. Cronbach's alpha is given as:

$$\alpha = \left(k\frac{k}{k-1}\right)\left(\left(1-\frac{\sum_{i=1}^{k}\sigma_{yi}^2}{\sigma_x^2}\right)\right.$$

where:

k = the number of scale items
σ_{yi}^2 = the variance associated with item i
σ_x^2 = the variance associated with the observed total scores

The reliability of σ coefficient ranges from 0 to 1. A minimum α coefficient of 0.65 is considered acceptable while α coefficients that are less than 0.5 are usually unacceptable. The higher the coefficient value, the more likely that the items measure the same concept [28]. In this study, alpha Cronbach coefficient was calculated as 0.84 and this shows that the instrument is reliable.

Four focus groups were also conducted with selected members of the general public in Ibadan, Akobo, and Asi. A total number of 23 participants attended the four focus group interviews. Factors such as age, gender, education, social class, place of work, and place of residence were considered in the selection to ensure that the groups were broadly representative of the society under study. Each focus group lasted for about 50 min and information was recorded digitally. Data was analysed based on the type and the source from which they are collected. Quantitative data was analysed using SPSS statistic software package Version 23, while qualitative data was analysed by a thematic method.

Table 1
Comparison between study sample and population data.

Gender	Population	Sample
Male	50%	52%
Female	49.7%	48%
Location		
Urban	67%	73%
Rural/Sub-Urban	33%	27%

Sources: [24,29].

5. Results

In the survey study, a close-ended questionnaire was administered to 600 participants at various locations in Ibadan, Akobo and Asi. A total of 423 filled questionnaires were returned. Two of the returned questionnaires were not usable, leaving 421 usable. This represents a 70.1% response rate. 219 of the participants were males (52% of the sample) while the remaining 202 participants were females (48% of the sample). Also, 310 responses (73% of the sample) were obtained from within Ibadan metropolis while 110 responses were from the sub-urban/rural areas. Table 1 below shows the comparison between the responses and the available population data of the survey area.

The age group of participants ranged from 20 to 60 years. They were grouped into four age groups; 20–29 years (45.6%), 30–39 years (27.1%), 40–49 years (19.2%) and 50–59 years (8.1%) as shown in Fig. 1 below.

Four focus group interviews were conducted with selected members of the general public in Ibadan, Akobo and Asi. Each focus group interview consisted of 6–10 participants. Two of the focus group interviews were conducted in Ibadan city: one in Mokola, which is an industrial area of the city, and another in Bodija, a commercial area. One focus group interview was also conducted in Asi and in Akobo (which are in the suburb of Ibadan) respectively. A total of 23 participants attended the focus group interviews. The numbers of the participants from each of the focus group interviews are summarised in Table 2 below. Although an equal

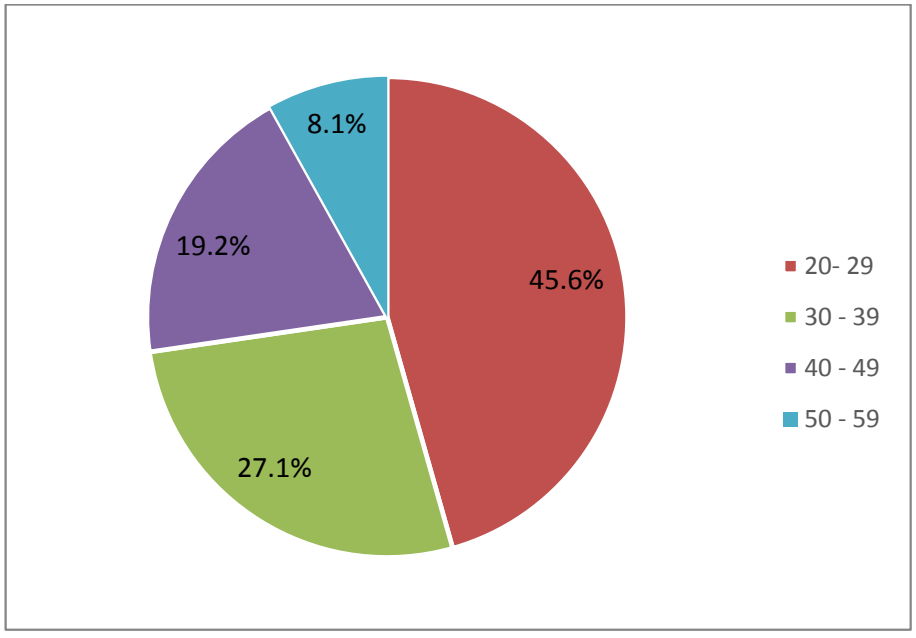

Fig. 1. Age group of participants.

Table 2
Summary of focus group participants.

Location	Male Participants	Female Participants	Total Participants
Mokola	7	–	7
Bodija	3	3	6
Akobo	–	3	3
Asi	4	3	7
Total	14	9	23

number of male and female participants were expected at the focus group interviews, a total of 14 male participants and nine female participants responded.

5.1. Education of participants

In both the survey and the focus groups, participants were sampled from different levels of education, ranging from no education to post graduate level of education. Table 3 shows the highest level of education reported by the sample for the survey while Table 4 shows the demographic summary statistics of the focus group participants.

5.2. Awareness of terms related to renewable energy technologies

The participants were asked to indicate their awareness of some of the terms related to RETs. These terms include: climate change; global warming; greenhouse emission; sustainable development and renewable energy. As revealed in Fig. 2 below, the results show that 70.5% were aware of climate change, 49.9% were aware of global warming, 22.6% were aware of greenhouse emission, 25.4% were aware of sustainable development, 43.5% were aware of renewable energy, and 4.0% were not aware of any of the terms. The term that the participants were most aware of was climate change (70.5%), while the term they were least aware of was greenhouse emission (22.6%). It is significant to note that only 43.5% of the sampled population were aware of RETs. This result is shown in Fig. 2 below.

In the focus group interviews, when asked if the participants had heard about global warming, 17 out of the 23 participants (73.1% of the participants) stated that they had. Also, when the participants were asked if they had heard about sustainable development, it was observed that none of the participants in Focus Groups 1 and 3 had any knowledge of sustainable development. In Focus Group 2, one person out of seven had an idea, and in Focus Group 4, one person out of three knew about sustainable development. Others in the groups had not heard of nor could describe sustainable development. Summarily, only two out of 23 participants had heard about sustainable development; this represents only 8.7% of the sampled population.

This result is also in line with what was obtained during the quantitative data analysis, where 107 out of 421 participants were aware of sustainable development. The two participants who were aware of sustainable development in the focus groups made the following statements:

> P13: "I think it's [sustainable development] something like direction, like a map."

Upon further probing, he could not explain further. The second participant said:

> P21: "Sustainable development, I have heard about it several times. Like in WHO Millennium Development Goals, sustainable development is one of the goals and I think it is the ninth Goal. That talks about inter-connectivity between different countries, low-income countries and high-income countries. To sustain

Table 3
Education of survey participants.

Education	Frequency	Valid Percent
Primary	4	1.0
Secondary	59	14.3
Ordinary National Diploma (OND)	34	8.2
National Certificate in Education (NCE)	18	4.4
Undergraduate	20	4.8
Graduate/Higher National Diploma (HND)	192	46.5
Post graduate	83	20.1
None	3	.7
Total	413	100.0

Table 4
Demographic summary of focus group participants.

Name	Gender	Education	Occupation	Age Range
P1	Male	HND	Printer	30–39
P2	Male	Undergraduate	Student	20–29
P3	Male	O Levels	Company Worker	40–49
P4	Male	Masters in Business Administration (MBA)	Banker	50–59
P5	Male	Primary	Spiral Binder	30–39
P6	Male	B.Sc.	Manager	50–59
P7	Male	O Levels	Student	20–29
P8	Male	B.Sc.	Agricultural Economist	30–39
P9	Male	HND	Accounting	30–39
P10	Male	B.SC	Psychologist	30–39
P11	Female	HND	Banker	40–49
P12	Female	HND	Marketer	40–49
P13	Female	OND	Marketer	30–39
P14	Male	B.Sc.	Administrator	40–49
P15	Male	B.Sc.	Banker	30–39
P16	Female	HND	Town Planner	30–39
P17	Female	B.Sc.	Secretary	40–49
P18	Male	NCE	Security	40–49
P19	Female	Undergraduate	Student	20–29
P20	Male	O Levels	Student	20–29
P21	Female	M.Sc.	Lawyer/Lecturer	50–59
P22	Female	B.Sc.	Nurse	50–59
P23	Female	Honours	Research Student	30–39

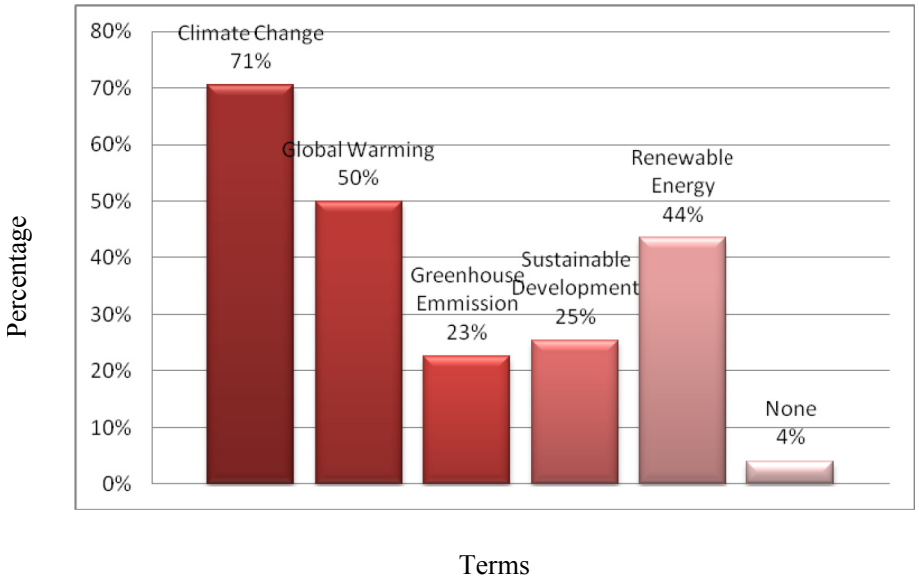

Fig. 2. Awareness of related terms by the participants.

the development of high income countries and to increase the development of low income countries and to be able to sustain their resources and to work together."

This finding points to the fact that most of the participants were not aware of sustainable development. This is in support of the result obtained in the quantitative segment of the study where only 25.4% of the survey population was aware of sustainable development. This low level is significant in terms of the public's acceptance of RET in Nigeria. It also indicates a need for energy education that will impact on the sustainable energy culture of Nigerians.

5.3. Type of renewable energy source familiar with

As shown in Fig. 3 below, when the survey participants were asked the type of renewable energy sources that they were familiar with, the responses indicated that; solar had the highest percentage at 69.8%. This was followed by bio waste at 32.8%, wind energy at 24.5%, small hydro at 10.7% and geothermal, which had the lowest percentage at 6.9%. The high percentage of the sampled population who could identify the sun as a source of renewable energy is significant.

In the focus group, when participants were asked if they are aware of renewable energy and what it means, a total of 18 out of 23 participants (78.2%) had heard about RET. This is higher than the survey result. Some of the statements made by the participants include:

P21: "Em … Em … What I can only say is maybe it has to do with natural sources of illumination to generate electricity rather than using electrical power from NEPA. When we use solar energy to generate power, that is renewable energy, or, when we use some other means to cause some illumination, then we say that we have achieved renewable energy."

P12: "What I know about RE is about conversion of a particular energy to another form. Like solar they convert it to heat energy. Various boreholes that are being dug by our politicians, they use solar to power the boreholes. They don't depend on conventional energy. The street lights also use RE."

Examples of renewable energy technologies mentioned included solar, wind and bio energy. Other technologies were not mentioned. This corresponds to the result obtained from the quantitative data analysis where the percentage of those who were aware of solar power was 69.8%, wind 24.5%, bio-energy 32.8%, as compared to geo-thermal at 6.9%, and micro-hydro at 10.7% of the population. The majority of the participants associated renewable energy with solar power.

Some of the participants, however, declared that although they had heard or seen renewable technologies in use, they did not know how these worked.

Some statements made by the participants include:

P21: "I have heard about it but I don't have a clear understanding of the concept. The only aspect of renewal of products I know about is when we have a waste product and we try to renew it to form another thing. Like when we have paper recycling. But for renewable energy, I don't have a clear understanding."

P6: "I heard it before but when I saw it, it was those street lights they use it for, they used it for those street lights and actually they have been using it to produce light for the street. I use that one as an example."

The responses indicates the level of awareness of renewable technology among the sampled population.

5.4. Sources of information about renewable energy technologies

In the survey, when asked for the source of information regarding RETs, the highest response percentage from the participants was for television (63.9%), followed by school (10.5%), radio (10.2%), internet (4.8%), and conferences (3.1%). About 3.6% had no access to information about RETs.

As shown in Fig. 4 above, the wide gap between the percentage of those who knew about renewable energy technology through television and those using other sources of information is very important to this study. Also, the low percentage of those who obtained information through school is significant to energy education in the country. Likewise in the focus group interviews,

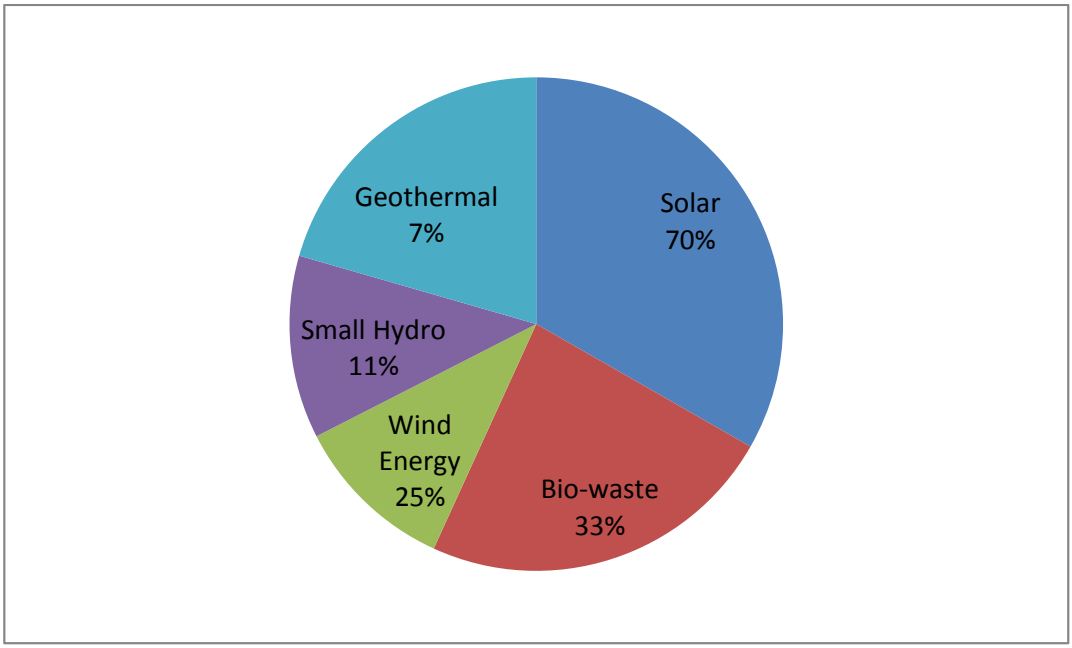

Fig. 3. Renewable energy sources the participants were familiar with.

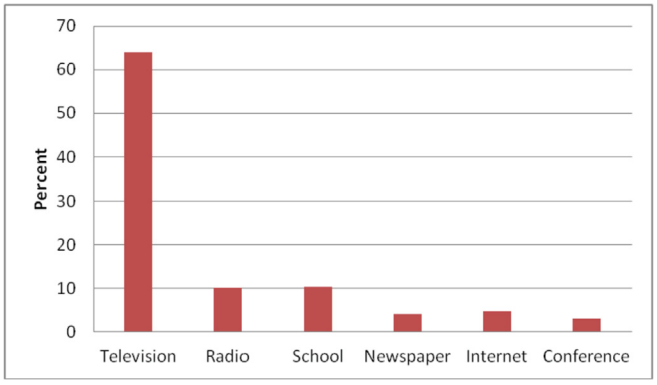

Fig. 4. Participants' sources of information about renewable energy technologies.

sources of information about RETs that were pointed out included radio, television, school (secondary school), reading in textbooks, seeing it in the neighbourhood, and taking a course about it at a tertiary institution.

5.5. Total knowledge

A total knowledge score was computed based on the knowledge of terms (five components) and knowledge of the different renewable energy sources (six components). Each component was given equal weight of one and therefore the least score expected is 0.00 while the highest score expected is score was 11. Table 5 shows the descriptive statistics of this "total knowledge score" of the sampled individuals. The average score is 3.797 (2.617), which is below 5.5 (half way point in the scale), showing a low level of knowledge.

As shown in Table 5 above, the minimum score was 0.0 (0.2%) and the maximum score was 11.0 (2.1%). The majority of the participants (45.6%) scored 2.0.

Table 5
"Total knowledge score" of the participants.

Total Knowledge	N	Minimum Score	Maximum Score	Mode	Mean Score	Standard Deviation
	421	0.00	11.00	2.0	3.767	2.602
Percentage		0.2%	2.1%	45.6%		

5.6. Knowledge score by gender

A box plot was plotted to compare the knowledge score by the two genders. From the box plot, there seems to be a difference in renewable energy knowledge between males and females. To check if this difference is significant, we carried out a *t*-test, as follows in Table 6 and Fig. 5. The p-value is < 0.001, which is less than the level of significance (0.05), the null hypothesis is rejected and our conclusion is that there is a difference in renewable energy knowledge between males and females in Nigeria, with the males having a higher score.

5.7. Knowledge scores by different levels of education

A one way ANOVA was done to compare the mean scores of the participants based on their highest level of education. The result shows a variation in the scores. While all levels of education had a less than average mean score (less than 5.0), the undergraduates had the highest mean score of 4.737, followed by the postgraduates with a mean score of 4.445, and NCE with a score of 3.50. Primary and secondary education had means of 3.250 and 3.440 respectively, while OND had a mean score of 3.059. Those with no education had a very low mean of 1.333, as shown in Table 7 below.

Table 8 shows a significance of 0.002, which is less than the level of significance 0.005, hence, we can conclude that there is no significant relationship between knowledge of RE technology in Nigeria and the level of education of the participants.

Table 6
T-test for significance of knowledge difference between males and females.

Total Knowledge	F	P-Value	T	df	Mean Diff	Std. Error Diff	95% Confidence Interval of the Difference	
							Lower	Upper
Equal Variance Assumed	19.657	0.0	4.159	417.000	1.04443	0.25110	0.55085	1.53802
Equal Variance Not Assumed			4.192	411.754	1.04443	0.24914	0.55469	1.53418

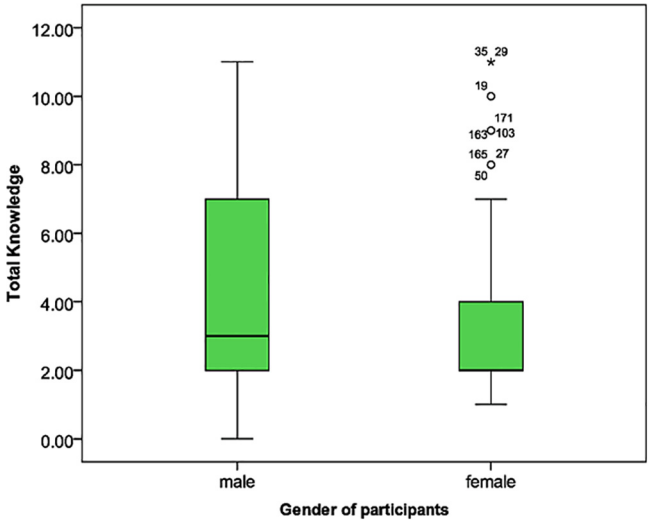

Fig. 5. Knowledge score by gender.

Table 7
Comparison of participants' highest level of education.

Level of Education	Number	Mean
Undergraduate	19	4.7368
Post graduate	83	4.4458
NCE	18	3.5000
Secondary	59	3.4407
Graduate/HND	191	3.3194
Primary	4	3.2500
OND	34	3.0588
No Education	3	1.3333

Table 8
One-way ANOVA test of participants' highest level of education.

ANOVA					
6	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	126.510	7	18.073	3.254	.002
Within Groups	2238.050	403	5.553		
Total	2364.560	410			

6. Discussion

As seen in both the quantitative and qualitative analyses of data, there is generally a low-level knowledge of RETs among the participants. Many of the participants only see RETs in use around them but do not know how they operate to generate energy. Also, only a few of the sampled participants had knowledge of greenhouse emission, despite the fact that the majority of the sampled population were aware of climate change. Studies have shown that while there is widespread awareness and concern about climate change, this often does not translate into personal engagement due to a lack of basic knowledge about causes, impacts and solutions to climate change [30–35]. The public's proper understanding of how the greenhouse effect works can therefore increase the likelihood of their engagement with policies to solve the problem.

Moreover, the quantitative data showed that only 25.4% were aware of sustainable development, and the qualitative analysis revealed that only two out of the 23 (8.7%) were aware of sustainable development. This result shows that there is a need for public education on sustainable development in relation to RETs in Nigeria. "To make progress towards more sustainable societies requires a population that is aware of the goals of sustainability and has the knowledge and the skills to contribute towards those goals" [15]. According to Hopkins and McKeown [36], public awareness, education and training are indispensable tools in ensuring a sustainable society. The role of education in sustainable development was also clearly stated in Agenda 21:

> "Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. It is critical for achieving environmental and ethical awareness, values and attitudes, skills and behavior consistent with sustainable development and for effective public participation in decision-making" ([8], Ch. 36, p.2).

There was a difference in renewable energy knowledge between male and female participants, with the males having a higher score (4.2982 as compared to 3.2537). Studies have shown that males are more technologically inclined than females in Nigeria, and globally [37–41]. It has also been shown that Nigerian tertiary institutions have produced more male graduates than females in the disciplines of science and technology [42]. There is a need for re-orientation and public awareness on the need for females to be more involved with science and technology in the country. The government should encourage more women to embrace science and technology through public lectures, incentives, female appointments to public science and technology positions, and projecting successful female scientists in the media.

Also, there is no relationship between the level of education and the knowledge score of the participants. Remarkably, the knowledge score for participants with OND qualifications, i.e., those with an industry-oriented education, was significantly lower than those of other levels of education (as shown in Table 6). These results are vital to science and technology education in the country. It has been observed that there is a lack of relevance of the school curriculum to the needs of Nigerian society and that there is a lack of flexibility in the curriculum to accommodate national and global changing needs, especially in science and technology education [43–46]. Adeyemi and Uko-Aviomoh [47] observe that a majority of polytechnic applicants in Nigeria prefer management courses, since they offer better job opportunities in the country. As a result of this, polytechnics in the nation do not comply with the admission ratio of 70:30 for science and technology/arts, social science and humanities, as stated in the national policy on education. They further report that other factors such as inadequate science materials, poor

laboratories, non-functioning workshops and the poor teacher student ratio contributed to the problems of polytechnics education in Nigeria.

An analysis of the sources of information about renewable energy technology revealed that sources of information included radio, television, schools, reading in textbooks and seeing it in the neighbourhood. In terms of the quantitative data, the majority of the sampled people had become aware of renewable energy from television (63.9%) followed by school (10.5%), radio (10.2%), the internet (4.8%), and conferences 3.1%. The potential knowledge obtained about RE from schools and conferences was surprisingly very little. This also points to the need for effective sustainable energy education in schools.

> "Formal education institutions play an important role in developing capacities from an early age, providing knowledge and influencing attitudes and behaviour. It is important to ensure that all pupils and students acquire appropriate knowledge of sustainable development and are aware of the impact of decisions that do not support sustainable development. An educational institution, as a whole, including pupils and students, teachers, managers and other staff as well as parents, should follow principles of sustainable development" [48].

The fact that most participants got the information about renewable energy through the television is significant to the acceptance of the technologies by the populace. The nature of renewable energy technology in terms of the complexity and sensitivity of energy issues in Nigeria demands that there should be proper energy education. According to Rogers [49], public acceptance of technologies slackens when a mass media is used to communicate complex innovations.

7. Conclusion/policy implications

The role of education in energy matters cannot be over emphasised. Education produces a better society. Knowledge and beliefs of the citizens about RETs will determine the type of attitude they will have towards their implementations. As shown in the study, there is a generally low level of energy education among the participants and the percentage of those who learnt about RE in schools is significantly low. The complexity of renewable energy technologies demands that energy education of the citizens should go beyond the use of mass media. There is a need to tailor the education curriculum towards the need of the society. Also, there should be more integration of sustainable development into the national science and technology policy and education. Energy education particularly should be widened to incorporate sustainability. This will help to develop a sustainable energy culture amongst Nigerians.

Apart from schools, media and forums such as public lectures, community forums, conferences, science and technology exhibitions on renewable energy products should be used to create awareness about RE among the citizens.

Educational policies that will promote more involvement of the female gender with science and technologies must be put in place. This can be in the form of gender preferences in admission procedure, employment, incentives, and appointment to public positions.

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